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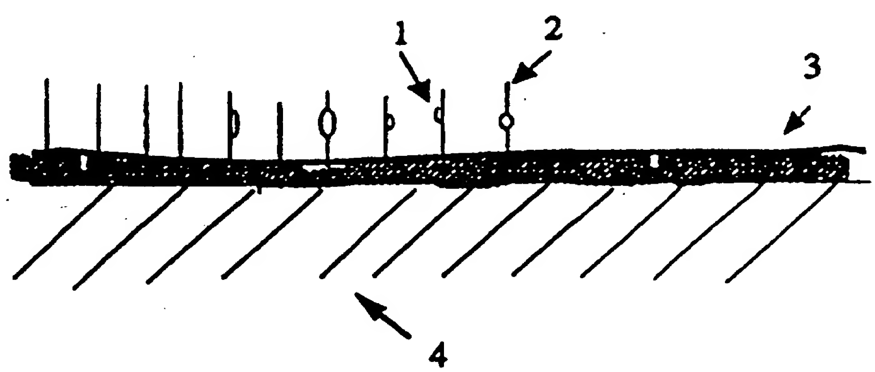
(54) Title: FOULING PROTECTION FOR CONSTRUCTIONS IN WATER

(57) Abstract

By using natural marine substances which are overgrowth preventing a very efficient protection can be obtained without use of environmental toxines. Examples of such natural substances are such being based on seaweed, in which there is a substance that prevents overgrowth, or such based on bacteria or other microorganisms which either themselves prevent, absorb or gormandize on harmful plants or animals or contain a substance that prevents overgrowth. These substances are bound to the marine construction either by this being made of a fibre material or by it being provided with a surface layer of a fibre material.



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Fouling protection for constructions in water.

Field of the invention:

The present invention refers to ships and other marine constructions which at least partly extend below the water surface. The word "marine" is here used not only for objects in sea water but also in sweet water in lakes, rivers etc. The invention particularly refers to treatment of surfaces below the water line to prevent fouling and maintain low friction for parts that move in the water. The invention also refers to treatment for preventing overgrowth on fishing tackle and other constructions that primarily are made of fibre material.

State of the art:

In order to prevent fouling of plants, animals and other organisms on ships and other marine constructions until now one has mainly used toxic colors. As is evident from the patent application WO, A1, 93/25432 one has also tested to cover surfaces, that are exposed to fouling, with fibre flock, which until now has proved to give good results.

The technical problem:

In some environments with extremely severe fouling merely coating with fibre flock on the hull surfaces has not given a sufficiently good protection. In certain cases, a completion of the protection can be needed. Today, nor for fishing nets and similar constructions made of fibres of synthetic or other materials there is found any good anti-fouling protection.

The solution:

By using natural marine substances that are overgrowth preventing, a very efficient protection can be obtained without need for environmental toxines to be utilized. Examples of such natural substances are such that are based on seaweed, in which a substance is present that prevents overgrowth, or such that are based on bacteria or other microorganisms that either themselves prevent, absorb or

gormandize on harmful plants or animals or contain a substance that prevents overgrowth. These substances are bound to the marine construction either by this being made of a fibre material or by it being provided with a surface layer of a fibre material.

By means of fibres that are flocked by known technique an active surface is formed that can be enlarged by 30-50 times in relation to the area of the base. It has also turned out that the fibre flock form an appropriate environment for different types of bacteria and other microorganisms. Bacteria which have a favourable influence on those plants or animals which constitute a problem are previously known, but before the origin of the present invention it has not been possible to create an environment in which the bacteria is retained on a surface so that a long-term action is obtained.

A fibre flocked surface has proved to form such an environment that solves the problem to retain active substances, waxes, bacteria or other microorganisms on surfaces which are located in connection to or under the water. The problem of severe overgrowth on for instance hull surfaces is solved by a fibre flocked surface in which an appropriate substance, bacteria or other microorganisms have been added.

The method to cover a surface with fibre flock is well known. It consists in that a surface first is coated with an adhesive whereupon electrically charged fibres are made to land in the adhesive and stick there. The adhesive is often a resin glue and the fibres are generally synthetic fibres of for instance polyamide.

However, the fibres which may come into question for the present invention are not limited to any special type, but also for instance coal fibres, glass fibres or non-synthetic fibres may be suitable. Especially to retain bacteria such fibres are suitable that bind a smaller amount of water such as for instance polyamide, which normally absorbs 2 - 4 % of

water. Even hollow fibres can be expected to have good characteristics to retain these substances and organisms.

In a preferred embodiment of the present invention a large amount of fibres is utilized which by electrostatic application to a large part will be fixed perpendicularly against the base. The fibre density can be in the range of 50-300 fibres per square mm, preferably more than 150 fibres per square mm, with a fibre thickness less than 0.1 mm, preferably less than 0.05 mm and a length in the range of 0.5-5 mm, preferably less than 3 mm.

In a second preferred embodiment the marine construction in itself is made of a yarn or a net of fibre material, whereby the fibre length is a good deal longer. Since these fibres are of an appropriate type to bind the actual anti-fouling substance, no fibre flock is required to obtain the intended effect according to the invention. In other cases a fibre flocking can be appropriate even when the marine construction is of fibre material.

Bacteria that can be used in connection with the present invention can for instance be of the family Alteromonas, but also other bacteria or microorganisms can be used according to the invention. The bacteria can be applied on surf[illegible] that are made of fibre material or which earlier hav[illegible] coated with a fibre flock, but it is also possible to pretreat the fibres with the bacteria in question before they are applied through flocking or before they are processed to a yarn, net or the like. It is probably possible to retain the culture of bacteria in the fibre flocked surface during a long period, even during periods of winter keeping during cold weather and the like. Bacteria which can be of interest in this connection can be kept freeze-dried during a long period. Other substances can also either be applied on earlier fibre flocked surfaces or be added to the fibre before this is applied.

Advantages:

Owing to the present invention one attains the advantage that less energy is required to operate a ship without overgrowth, which means cost savings and less stress on the environment. Since boats and other marine constructions are provided with natural anti-fouling substances, bacteria or other micro-organisms in fibre material of which the constructions are built or in fibre flock which has been applied on surfaces under the water line, this counteracts growth of algae and other growths and animals on the surfaces. One can therefore dispense with the use of toxic substances such as red lead to avoid such growth. This further strengthens the environmental promotion effect of the invention.

Examples:

Tests with bacteria and seaweed on flocked surfaces have been carried out and are described with reference to the drawings in which

Figure 1 shows schematically bacteria adhered to fibers,

Figure 2 shows an electron micrograph photo of D2 cells colonizing the outer part of a bunch of fibres,

Figure 3 shows D2 cells colonizing fibres inside a bunch of fibres,

Figures 4 and 5 show close up photos of D2 cells colonizing a fibre,

Figure 6 shows samples from test with bacteria D2, and

Figure 7 shows samples from test with seaweed Delicea.

Tests with bacteria D2.

Flock was put into a bacteria suspension for approx. 36 hours in room temperature. This is the normal procedure. Then the fibres were washed in a salt (NaCl). The fibres and the bacteria were then fixed in 2.5% gluteraldehyd in 0.1M Na cacodylate buffer and later in 2% osmium tetraoxide. The samples were washed in ethanol (from 50% to 100%) and transferred to 100% acetone. In between these tests the samples were also mechanically tested by putting them into a centrifugal device. This shows that the bacteria colonize the fibers strongly and very successfully. In Figure 1 is

schematically shown colonies of bacteria 1 on flocked fibres 2 fixed on a base 4 by means of an adhesive 3. Electron micrograph photos of Figures 2 to 5 show the colonizing of bacteria D2 on polyamid 6.6 fibres. This test was made at the New South Wales University in Sydney, Australia.

Tests with bacteria D2 and seaweed, Delicea at sea in Sydney, Australia.
Tubes with various types of flockfibres where coated with extract from D2 and Delicea. Untreated tubes having only flockfibers where put into the sea together with the treated tubes for a period of 7 weeks in an area with controlled and severe fouling in Sydney, Australia. In Figures 6 and 7, tubes C are control tubes with untreated flock, tube B in Figure 6 is treated with bacteria D2, tube A in Figure 7 is also treated with Seaweed Delicea.

The effect of both bacteria and extracts were analysed after the testing period and the addition of both bacteria and seaweed extract enhanced the overall effect of soft fouling as bryozonas, hydroids. In some instances the total percent cover of organisms on treated flocks were less than 1%.

The invention is not limited to the above embodiments but can be varied in different ways within the scope of the patent claims.

CLAIMS

1. A method for preventing fouling on ships and other constructions in water, wherein natural substances, waxes, bacteria or other microorganisms that inhibit fouling are added to at least parts of the ships or other constructions, which consist of or have been coated with fibre material.

2. A method according to claim 1, wherein the fibre material consists of fibre flock.

3. A method according to claim 2, wherein the fibre flock consists of synthetic textile fibres applied in an adhesive on the surfaces with an electrostatic application technique.

4. A method according to claim 2 or 3, wherein the length of the fibres is between 0.5 and 5 mm and a density range of 50-300 fibres per square mm.

5. A method according to any of claims 1-4, wherein the substance is extracted from seaweed.

6. A method according to any of claims 1-4, wherein the bacteria are of the family Alteromonas.

7. A ship or other marine construction wholly or partially made of fibre material or provided with fibre flock on those surfaces which come in contact with the water, wherein natural substances, waxes, bacteria or other microorganisms that inhibit overgrowth by plants, animals and/or harmful microorganisms are added to the fibre or at least parts of the fibre flocked surfaces.

8. A ship or other marine construction according to claim 7, mainly made of yarn or net of long fibres.

9. A ship or other marine construction according to claim 7 or 8, wherein the fibre flock consists of synthetic fibres

which are applied in an adhesive on the surfaces with an electrostatic technique.

10. A ship or other marine construction according to claim 9, wherein the synthetic fibres in the fibre flock has a length between 0.5 and 5 mm and a density range of 50-300 fibres per square mm.

11. A ship or other marine construction according to any of claims 7-10, wherein the substance is extracted from seaweed.

12. A ship or other marine construction according to any of claims 7-10, wherein the bacteria are of the family Alteromonas.

13. The use of natural substances, waxes, bacteria or other microorganisms for inhibiting ongrowth on ships or other marine constructions in combination with long fibres or fibre flock which constitute carrier for the substances, the bacteria or the other microorganisms.

Fig. 1

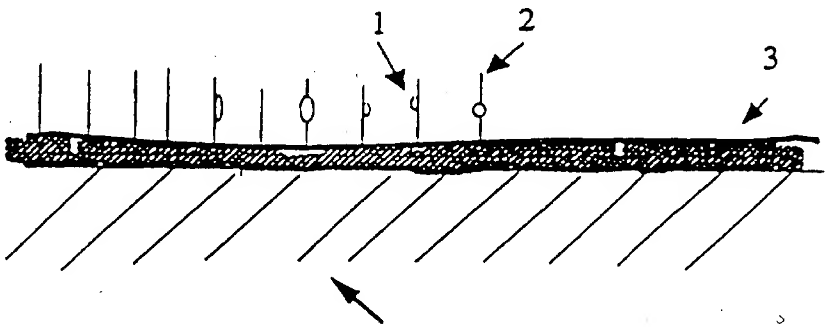


Fig. 2

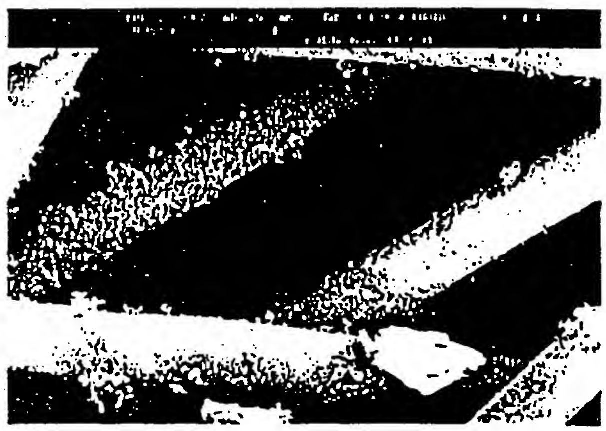


Fig. 3

Fig. 4

Fig. 5

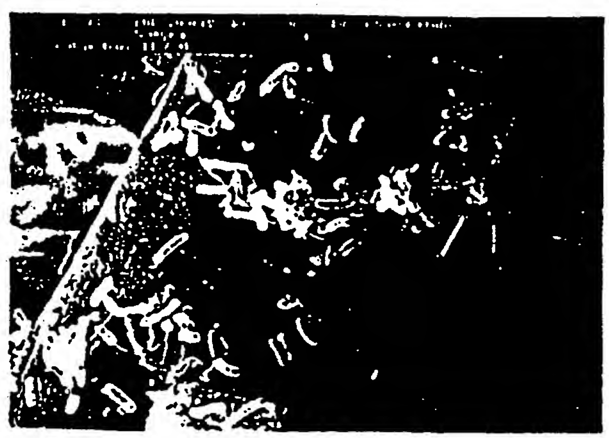
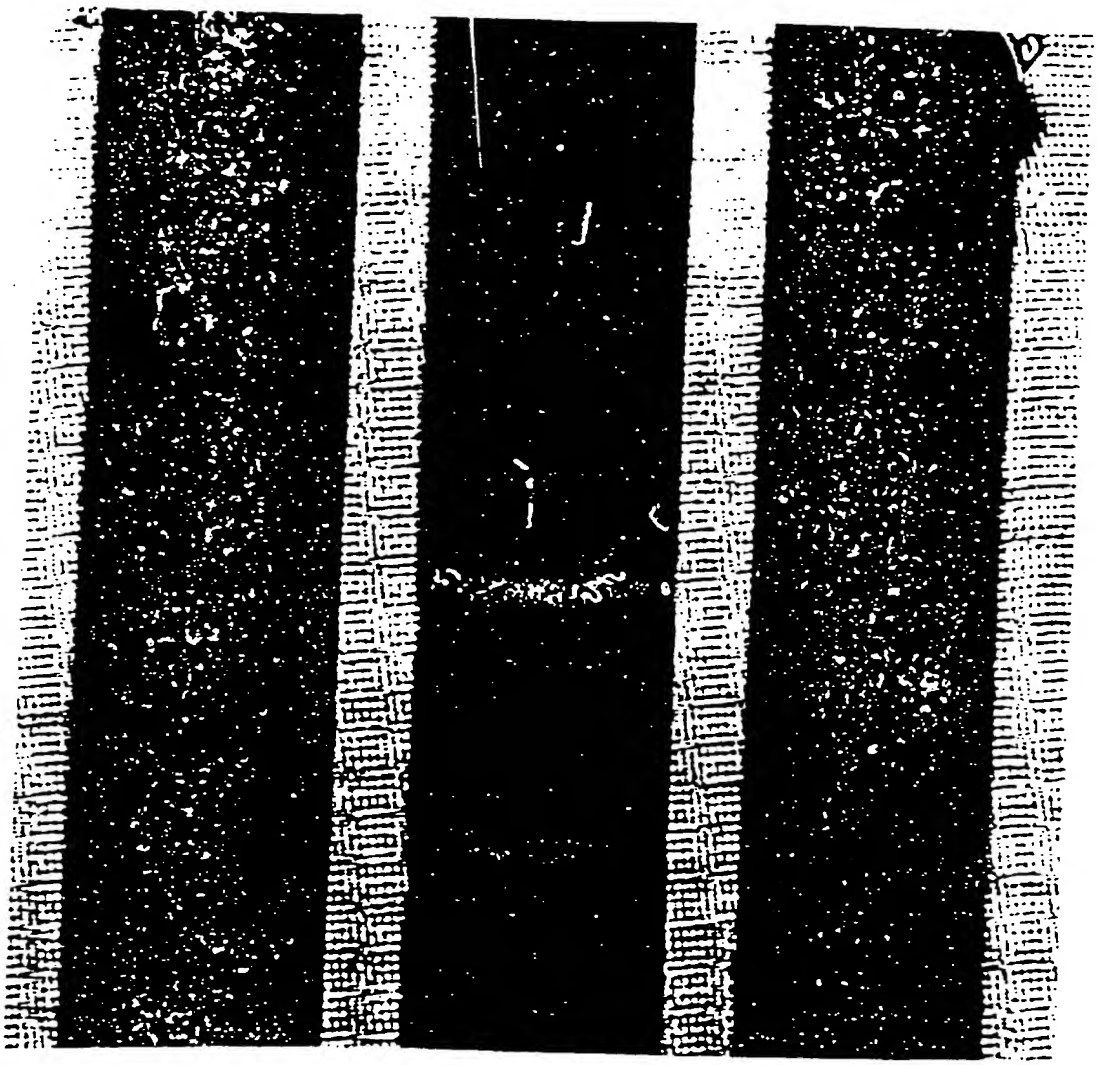
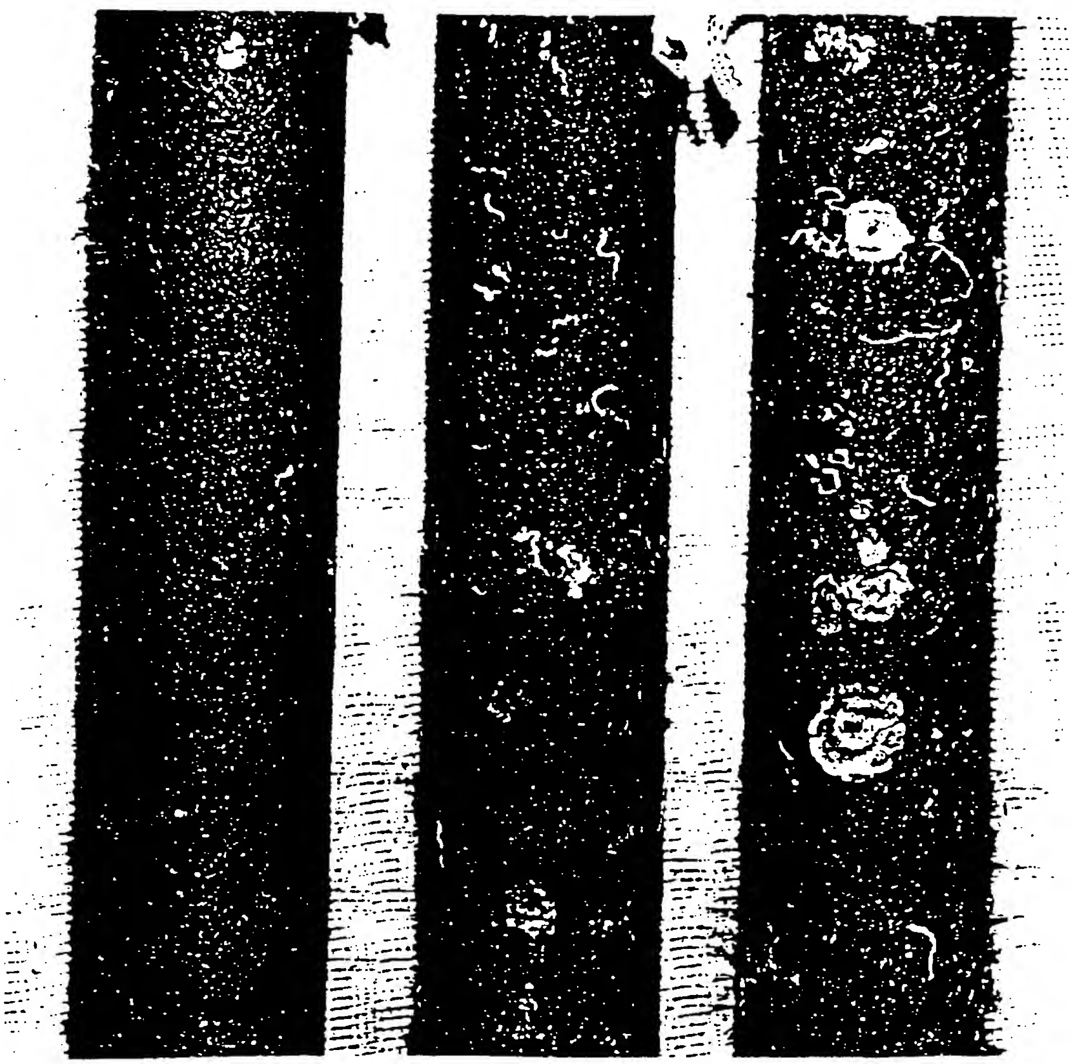


Fig. 6



A B C

Fig. 7



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INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 95/00894

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: B63B 59/04, C09D 5/16
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: B63B, C09D, B05D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 9325432 A1 (JURISTBYRAN INDIREKT AB), 23 December 1993 (23.12.93) -- --------	1,7

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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11 October 1995	13-11-1995

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INTERNATIONAL SEARCH REPORT

28/08/95

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WO-A1- 9325432	23/12/93	NONE	

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